

## PATENT ABSTRACTS OF JAPAN

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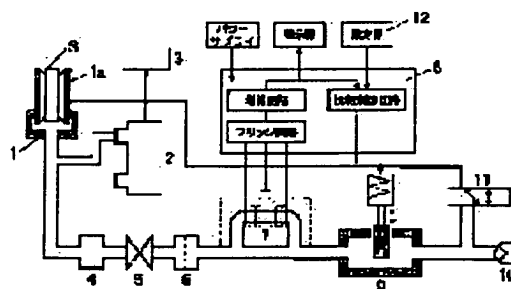
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## (54) AIR FLOW RESISTANCE MEASURING APPARATUS

## (57)Abstract:

**PURPOSE:** To obtain a compact measuring apparatus capable of accurately measuring the air flow resistance of a sample by making the flow rate of air sucked by the sample constant and measuring the differential pressure between the inflow and suction sides of the sample.

**CONSTITUTION:** Chucking rubber tube 1a in a plug holder 1 is opened by a changeover valve 11 for fitting a sample and a calibrating reference plug is set to the rubber tube 1a. For example, in the case of a tobacco filter, air flow resistance is predetermined corresponding to a brand and a proper calibrating reference plug is selected according to an object to be measured. Next, suction is started with a vacuum pump 10 and an air flow rate is adjusted to a reference flow rate by a reference flow rate setting device 12. At this time, the flow rate of air is measured by a flowmeter 7 and a control valve 9 is continuously controlled through a valve control circuit 8 so as to become a set reference flow rate. After an air flow rate reaches the reference flow rate, the calibrating reference plug is detached and a filter S to be measured is set to the holder 1 and the differential pressure between the inflow and suction sides of the filter S is measured by a differential pressure sensor 2.



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CLAIMS

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[Claim(s)]

[Claim 1] The attachment component for holding a specimen so that it may be equipment which measures the gaseous ventilation resistance which passes through the inside of a rod-like specimen, the end side of a specimen may be wide opened by atmospheric air and the suction way which attracts a gas may be connected to other one end, The vacuum pump for attracting the gas of a fixed flow rate through said suction way, The criteria flow rate setting means for setting this gas as constant flow, and the flowmeter which measures the flow rate of the gas in said suction way, The control bulb which is connected with this flow meter and located between said vacuum pumps, The ventilation resistance measuring device characterized by measuring the differential pressure by the side of the inflow of a specimen, and suction after making into constant flow the flow rate of the gas which has and attracts the differential pressure gage which measures the differential pressure by the side of the inflow of a specimen, and suction by said control bulb.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the equipment which measures ventilation resistance by making a cigarette, a filter, etc. into a specimen.

[0002]

[Description of the Prior Art] The filter of a cigarette must be the thing of fixed ventilation resistance in each product. Conventionally, in the equipment which measures ventilation resistance, it draws in by the fixed criteria flow rate, for example from the end side of a specimen like a filter, and the equipment which measures the differential pressure of the inlet port of a specimen and an outlet is known. As shown in drawing 2 , in order to draw in by the fixed criteria flow rate, JP,5-45135,B forms the multiplex capillary tube element expression sensor H and the control bulb 9 between Specimen S and a suction pump 10, after having sensed differential pressure by this multiplex tubing element expression sensor H and converting this to the rate of flow in the suction path 13, performs a valve control, and is taken as a setting criteria flow rate. That is, it is equipment which measures permeability with the rate of the flow of the air over the differential pressure which passes per unit area of a specimen, and along a specimen.

[0003]

[Problem(s) to be Solved by the Invention] However, it is the device which controls the opening of a control bulb by such equipment after measuring the differential pressure within a suction path by the multiplex tubing element expression sensor H and converting this to the rate of flow, in order to make the amount of the drawing-in air into the specified quantity. Therefore, since it is based on the rate of flow of the air which a control circuit becomes complicated and draws in, there is a trouble that it influences the accuracy of measurement, in response to the effect of the pressure loss and the turbulent flow in piping, or fluid temperature. This invention makes it a technical problem to be able to perform correctly ventilation resistance measurement of the specimen which consists of restoration objects, such as a cigarette and a filter, and to offer a compact measuring device.

[0004]

[Means for Solving the Problem] The ventilation resistance measuring device of this invention made in order to solve the above-mentioned technical problem The attachment component for holding a specimen so that it may be equipment which measures the gaseous ventilation resistance which passes through the inside of a rod-like specimen, the end side of a specimen may be wide opened by atmospheric air and the suction way which attracts a gas may be connected to other one end, The vacuum pump for attracting the gas of a fixed flow rate through said suction way, The criteria flow rate setting means for setting this gas as constant flow, and the flowmeter which measures the flow rate of the gas in said suction way, After connecting with this flow meter, having the control bulb located between said vacuum pumps, and the differential pressure gage which measures the differential pressure by the side of the inflow of a specimen, and suction and making the flow rate of the drawing-in gas into constant flow by said control bulb, it is characterized by measuring the differential pressure by the side of the inflow of a specimen, and suction.

[0005]

[Function] Suction is started with a vacuum pump 10 and the flow rate is measured with a flowmeter. It is controlled by the control bulb connected with the flow meter by the set-up flow rate.

Since the mass flow rate is measured regardless of the rate of flow at this time, it can be set as an exact flow rate, without being influenced of the pressure loss in tubing etc. And after becoming a predetermined gas flow rate, the differential pressure by the side of the inflow of a specimen and suction is measured.

[0006]

[Example] Drawing 1 is the block diagram showing one example of the ventilation resistance measuring device of this invention. The filter S of the tobacco which is a specimen is set to the plug holder -1 as an attachment component, at this time, the end of Filter S is wide opened by atmospheric air, and other ends are attracted by the vacuum pump 10 through the suction way 13. The inside of the plug holder -1 holds a specimen by rubber tube 1a for chucks, and the closing motion is performed by the change-over valve 11 for specimen wearing.

[0007] The flowmeter 7 formed all over the suction way 13 uses a mass flow rate sensor, and measures the mass flow rate of a fluid. Two exoergic resistors are rolled in sensor tubing, when the sink sensor was heated and a gas flows, a temperature gradient produces a current in two points, and this regards this temperature change as a change in resistance, and measures a flow rate using these and the gaseous specific heat being in functional relation. And this flow meter 7 is connected with the control bulb 9, and the flow rate set up by the setter 12 which is a criteria flow rate setting means controls [ whether it is flowing correctly and ] by the flow meter 7 and the control bulb 9. Since the flow rate is measured from the temperature change, without converting the gaseous rate of flow to a flow rate at this time, the effect of the turbulent flow in tubing or pressure loss is reduced, and accuracy and responsibility can control well. In this example, although the mass flowmeter of a heat type was used as a flowmeter, a rotameter may be used.

[0008] Next, a measuring method is explained. By the change-over valve 11 for specimen wearing, rubber tube 1a for chucks in the plug holder -1 is opened, and the criteria plug for proofreading is set there. This criteria plug for proofreading is chosen by the specification of the object for 300mmAq, those with two or more [ other ] for 600mmAq(s), and a specimen. For example, if it is the filter of tobacco, ventilation resistance will be decided with each brand and the suitable criteria plug for proofreading will be chosen by the device under test. After setting the criteria plug for proofreading, rubber tube 1a for chucks is stuck to a plug.

[0009] Next, suction is started with a vacuum pump 10 and it adjusts to 17.5 cc/sec which is criteria flow rates in the setter 12 of a criteria flow rate. At this time, a flow rate is measured with a flow meter 7, and control is continuously performed so that it may become a setting criteria flow rate by the control bulb 9 through the bulb control circuit 8. After becoming the set-up criteria flow rate, the criteria plug for proofreading is removed and the filter S for [ measured ] is set to the plug holder -1.

[0010] And by the differential pressure sensor 2, the differential pressure by the side of the inflow of the filter S for [ measured ] and suction is measured, differential pressure is read on the differential pressure force display 3, and it checks whether it is a predetermined ventilation resistance value.

[0011]

[Effect of the Invention] According to the ventilation resistance measuring device of this invention, as explained above, since the flow rate of a direct gas is measured and it was made to control setting control of a criteria flow rate by the control bulb continuously, the effect of the turbulent flow in tubing or pressure loss is reduced, and accuracy and responsibility can control well. Thus, ventilation resistance can be measured under the air flow rate which was always fixed. Moreover, a bulb control circuit is not complicated and the whole equipment serves as a compact.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is drawing showing one example of this invention.

[Drawing 2] It is drawing showing the conventional ventilation resistance measuring device.

[Description of Notations]

S A specimen, 1 Plug holder -, 2 A differential pressure gage, 3 A differential pressure force display, 4 An air filter, 5 A flow control valve, 6 An air filter, 7 A flow meter, 8 bulb control circuit, 9 A control bulb, 10 A vacuum pump, 11 The change-over valve for specimen wearing, 12 A criteria flow rate setter, 13 A suction way, H Multiplex capillary tube element expression sensor

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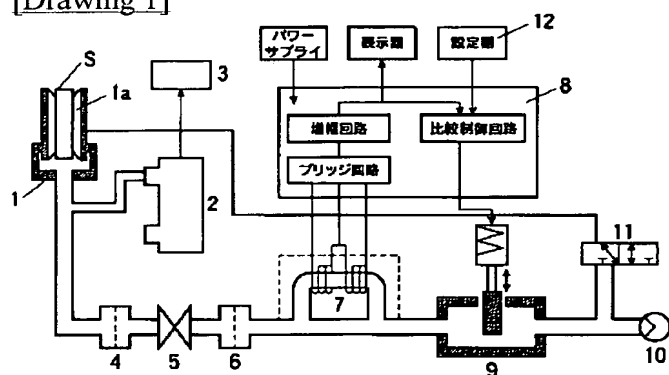
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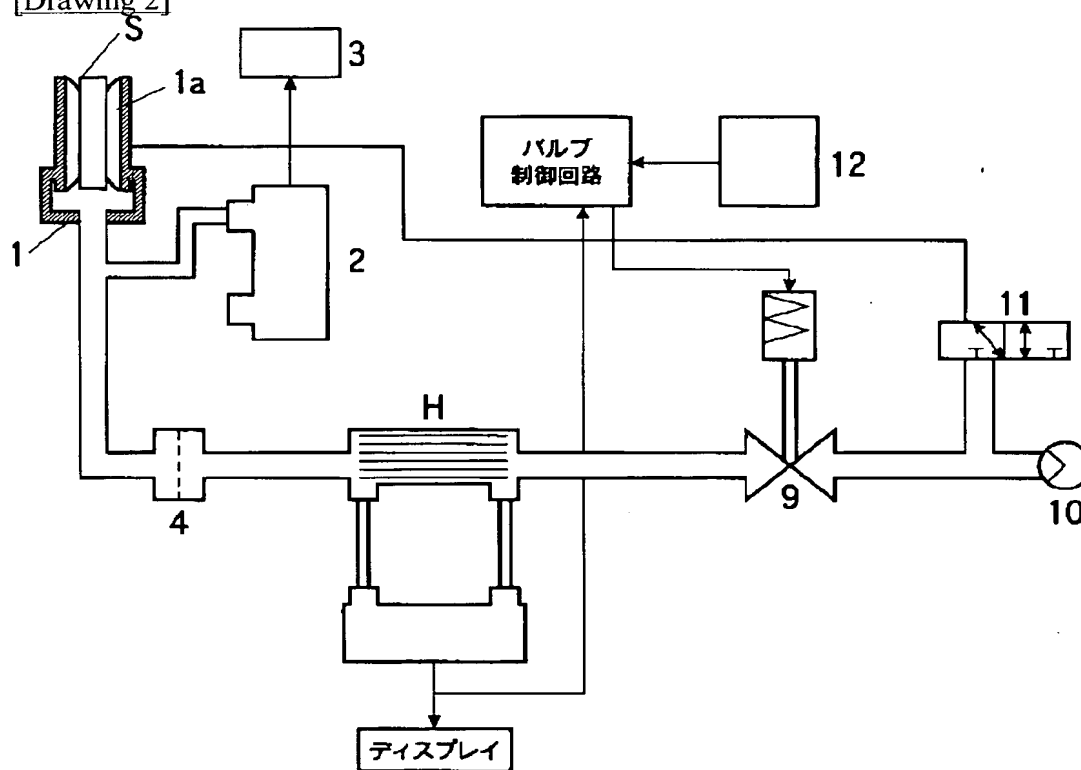
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## DRAWINGS

[Drawing 1]



[Drawing 2]



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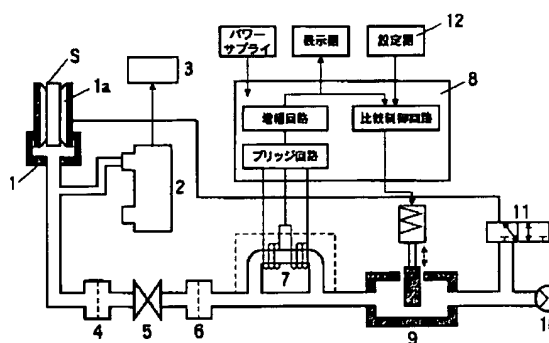
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(54) 【発明の名称】 通気抵抗測定装置

(57) 【要約】

【目的】充填体からなる検体の通気抵抗を測定する装置に関し、コンパクトかつ正確に測定できる装置を提供する。

【構成】真空ポンプにより所定量の空気の吸引を行い、その流量を流量計で計測する。そして、基準流量設定器で設定された流量となるように制御バルブで制御を行う。この時、質量流量を測定制御しているので正確な流量に設定でき、所定の流量となった後、検体の流入側と吸引側の差圧を測定する。





## 【特許請求の範囲】

【請求項 1】 棒状の検体の中を通過する気体の通気抵抗を測定する装置であって、  
検体の一端側が大気に開放され、他の端側に気体を吸引する吸引路を接続するように検体を保持するための保持部材と、  
前記吸引路を介して一定の流量の気体を吸引するための真空ポンプと、  
該気体を一定流量に設定するための基準流量設定手段と、  
前記吸引路中の気体の流量を測定する流量計と、  
該流量計と連結され、前記真空ポンプとの間に位置する制御バルブと、  
検体の流入側と吸引側の差圧を測定する差圧計とを有し、  
吸引する気体の流量を前記制御バルブにより一定流量とした後、検体の流入側と吸引側の差圧を測定することを特徴とする通気抵抗測定装置。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】 本発明は紙巻たばこ、フィルターなどを検体として通気抵抗を測定する装置に関するものである。

## 【0002】

【従来の技術】 紙巻たばこのフィルターは、各製品においては、一定の通気抵抗のものでなければならない。従来、通気抵抗を測定する装置においては、例えばフィルターのような検体の一端側から一定の基準流量で吸引を行い、検体の入口と出口の圧力差を計測する装置が知られている。特公平 5-45135号は、図 2 に示すように、一定の基準流量で吸引を行うために、検体 S と吸引ポンプ 10 の間に多重毛管要素式センサ H と制御バルブ 9 を設け、吸引経路 13 内において、この多重毛管要素式センサ H で差圧を感知し、これを流速へ換算したうえでバルブ制御を行い設定基準流量とするものである。すなわち、検体の単位面積あたり、検体を通る圧力差に対する空気の流れの速度をもって通気性を測定する装置である。

## 【0003】

【発明が解決しようとする課題】 しかしながら、このような装置では、吸引する空気の量を所定量とするために多重毛管要素式センサ H で吸引経路内の差圧を測定し、これを流速へ換算したうえで制御バルブの開度を制御する機構である。そのため、制御回路が複雑となり、また吸引する空気の流速を基準としているため、配管中の圧力損失や乱流又は流体温度の影響を受け、それが測定精度に影響するという問題点がある。本発明は、紙巻たばこ、フィルターなどの充填体からなる検体の通気抵抗測定を正確に行うことができ、かつコンパクトな測定装置を提供することを課題とする。

## 【0004】

【課題を解決するための手段】 上記課題を解決するためになした本発明の通気抵抗測定装置は、棒状の検体の中を通過する気体の通気抵抗を測定する装置であって、検体の一端側が大気に開放され、他の端側に気体を吸引する吸引路を接続するように検体を保持するための保持部材と、前記吸引路を介して一定の流量の気体を吸引するための真空ポンプと、該気体を一定流量に設定するための基準流量設定手段と、前記吸引路中の気体の流量を測定する流量計と、該流量計と連結され、前記真空ポンプとの間に位置する制御バルブと、検体の流入側と吸引側の差圧を測定する差圧計とを有し、吸引する気体の流量を前記制御バルブにより一定流量とした後、検体の流入側と吸引側の差圧を測定することを特徴とする。

## 【0005】

【作用】 真空ポンプ 10 により吸引を開始し、その流量を流量計によって測定する。流量計と連結された制御バルブにより、設定された流量に制御される。この時、流速に関係なく質量流量を測定しているため、管内の圧力損失等の影響も受けずに、正確な流量に設定できる。そして、所定の気体流量になった後、検体の流入側と吸引側の差圧を測定する。

## 【0006】

【実施例】 図 1 は、本発明の通気抵抗測定装置の一実施例を示す構成図である。検体であるたばこのフィルター S は、保持部材としてのプラグホルダー 1 にセットされ、このとき、フィルター S の一端は大気に開放され、他の一端は真空ポンプ 10 により吸引路 13 を介して吸引される。プラグホルダー 1 内は、チャック用ゴムチューブ 1a により検体を保持するようになっており、その開閉は検体装着用切換弁 11 で行う。

【0007】 吸引路 13 中に設けられた流量計 7 は質量流量センサを使用し、流体の質量流量を測定するものである。これは、センサ管内には 2 つの発熱抵抗体が巻かれており、電流を流しセンサを加熱すると、気体が流れた時に 2 点間で温度差が生じ、この温度変化を抵抗値変化として捉え、これらと気体の比熱とが関数関係にあることを利用して流量を測定するものである。そして、この流量計 7 は制御バルブ 9 と連結されており、基準流量設定手段である設定器 12 により設定された流量が正確に流れているかを流量計 7 と制御バルブ 9 によって制御を行うものである。この時、気体の流速を流量へ換算することなく、温度変化から流量を測定しているので、管内の乱流や圧力損失の影響を低減し正確かつ応答性がよく制御できる。本実施例では、流量計として熱式の質量流量計を用いたが、ロータメータでもよい。

【0008】 次に、測定方法について説明する。検体装着用切換弁 11 によって、プラグホルダー 1 内のチャック用ゴムチューブ 1a を開き、そこに校正用基準プラグをセットする。この校正用基準プラグは、300mmAq 用

と600mmAq用その他複数あり、検体の規格により選択されるものである。例えば、たばこのフィルターであれば各銘柄により通気抵抗が決められていて、被測定物によって適当な校正用基準プラグを選択する。校正用基準プラグをセットした後、チャック用ゴムチューブ1aをプラグへ密着させる。

【0009】次に、真空ポンプ10により吸引を開始し、基準流量の設定器12で基準流量である17.5cc/secに調整する。この時、流量計7で流量を計測し、バルブ制御回路8を介して制御バルブ9で設定基準流量となるように連続的に制御が行われる。設定した基準流量となった後、校正用基準プラグを取り外し被測定用フィルターSをプラグホルダー1へセットする。

【0010】そして、差圧センサ2によって、被測定用フィルターSの流入側と吸引側の差圧を測定し、差圧力ディスプレイ3で差圧を読取り、所定の通気抵抗値であるかどうかの確認を行う。

【0011】

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\*【発明の効果】以上説明したように本発明の通気抵抗測定装置によれば、基準流量の設定制御を直接気体の流量を測定し、制御バルブで連続的に制御を行うようにしたので、管内の乱流や圧力損失の影響を低減し正確かつ応答性がよく制御できる。このように、常に一定した空気流量の下で通気抵抗が測定できる。また、バルブ制御回路が複雑でなく装置全体がコンパクトとなる。

【図面の簡単な説明】

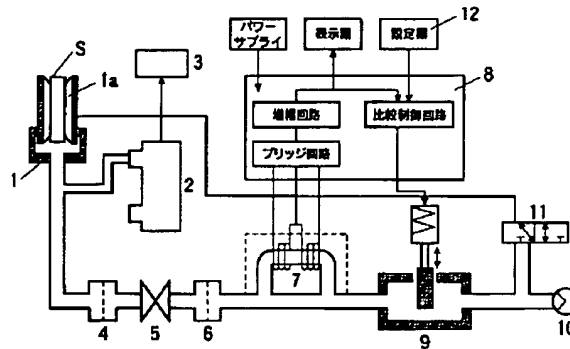
【図1】本発明の一実施例を示す図である。

【図2】従来の通気抵抗測定装置を示す図である。

【符号の説明】

S 検体、1 プラグホルダー、2 差圧計、3 差圧力ディスプレイ、4 エアフィルター、5 流量調節弁、6 エアフィルター、7 流量計、8バルブ制御回路、9 制御バルブ、10 真空ポンプ、11 検体装着用切換弁、12 基準流量設定器、13 吸引路、H 多重毛管要素式センサ

【図1】



【図2】

